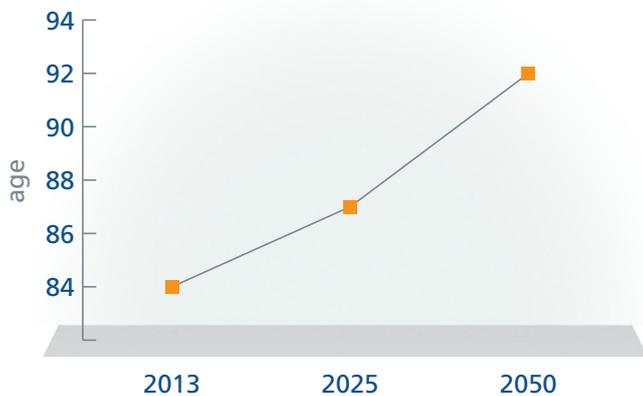


SINGAPORE

COUNTRY OVERVIEW

In just over a decade, the number of Singaporeans aged over 70 years will increase by 103%. Life expectancy is also increasing, rising from 84 years to 92 years by 2050 (Figure 1). The proportion of the population aged greater than 70 years is expected to rise from 289,000 in 2013 to 1.5 million in 2050 (Figure 2). The population aged over 50 years will increase from 1.3 million today to 3.9 million in 2050, making up 46% of the total population. The dramatic increase in the senior population of Singapore is especially evident when one considers that the *total* population is expected to increase just 58%, from 5.4 million today to 8.6 million in 2050¹.

FIGURE 1 Life expectancy in Singapore



State of osteoporosis/osteopenia

Age-adjusted rates of osteoporotic fractures among women over the age of 50 years in Singapore are currently among the highest in Asia and approaching those of the USA and Europe². The IOF Asian Audit of 2009 reported on 2006 figures estimating that approximately 55,000 Singaporean women over the age of 50 years suffered from osteoporosis. With an ageing population, these figures are expected to increase several-fold.



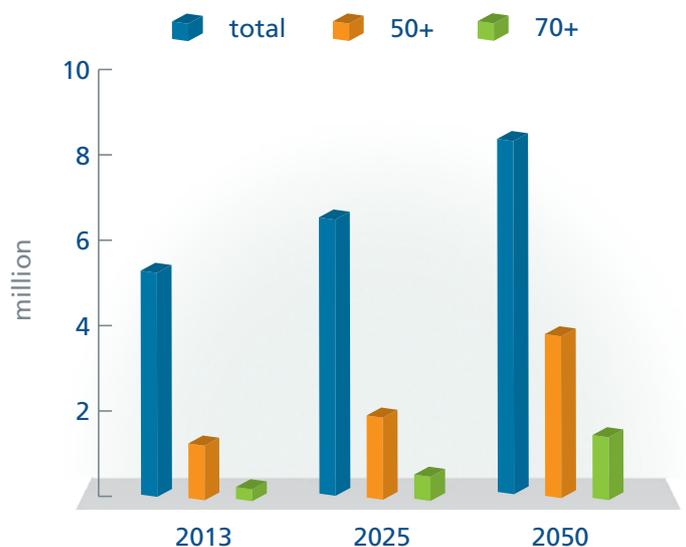
CURRENT

Population **5.4 million**
 Aged over 50 years **24%**
 Life expectancy **84 years**
 Hip fracture incidence per year **402/100,000** (women)
 Cost per hip fracture **8,380 USD**
 Number of DXA per million population **16.9**
 Fracture liaison services **>50% of hospitals**
 National health priority status **since 2009**

PROJECTED 2050

Population **8.6 million** ↑
 Aged over 50 years **46%** ↑
 Life expectancy **92 years** ↑

FIGURE 2 Population projection for Singapore

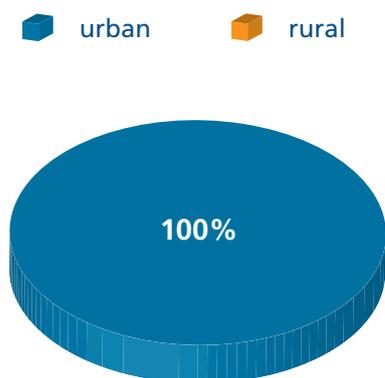


Also, recent studies have noted that secondary osteoporosis is becoming more common than previously perceived, with the overall prevalence close to 50% in postmenopausal women and older men with osteoporosis³.

Lifestyle

Singapore has a unique ethnic population mix of Chinese (76.8%), Malay (13.9%), Indian (7.9%), and others (1.4%), and is a fully urbanized country (Figure 3)^{1,4}. Studies from 1960-1980 showed rapidly rising fracture trends in Singapore, and it is suggested that urbanization is the culprit – leading to changes in physical activity, nutrition and sunlight exposure.

FIGURE 3 Urban versus rural population in Singapore



Nutritionally, calcium levels are low in Singapore's men and women. The current dietary recommendation for calcium intake in Singapore is 800 mg/day, but according to the 2004 National Nutrition Survey, the average daily calcium intake of Singaporeans was 627 mg/day, just 78% of the recommended levels⁵.

Vitamin D insufficiency and deficiency is also prevalent in Singapore. One study found that of 275 hip fracture patients, half were vitamin D deficient (<20 ng/mL)⁴.

On a positive note, those with osteoporosis appear to be taking measures to manage the disease. A study of almost 800 Singaporean osteoporosis patients indicated that adherence to bisphosphonate therapy is higher in Singapore than it has been reported to be in Europeans and Americans. After one year, 78.9% of patients were

compliant with taking the correct dosage of medication and 69% were still compliant at 2 years².

Level of awareness

There is a fair level of awareness about osteoporosis in Singapore and there are ample resources, however it is the implementation of osteoporosis management that is lacking. A survey conducted in 2010 amongst health-care professionals showed many aspects of osteoporosis care were not being conducted, such as screening for secondary causes and use of fracture risk calculators. This suggests that physicians could be more aligned with the guidelines that are available on osteoporosis management³.

In the general population, a survey found that 39% of patients rated vitamin D as extremely important, and 55% rated calcium as extremely important. On the other hand, according to another survey, 86% of patients reported they had no or infrequent discussions with their physicians regarding vitamin D, and 76% reported the same about calcium⁶.

FRACTURE RATES

Hip fracture

The highest incidence of hip fractures from Asia has been reported in Singapore: the study by Koh et al. revealed that hip fracture rates from 1991 to 1998 (per 100 000 per year) were 152 in men and 402 in women. These were respectively 1.5- and 5-times higher than corresponding rates in the 1960s, and approach rates seen in American and European populations^{7,8}.

The high incidence of mortality after hip fracture does not bode well for those suffering from such events. Data from Singapore show that the mortality rate one year post-fragility hip fracture is approximately 20–27%, with another 20% semi or fully dependent, and 39% experiencing reduced mobility. Finally, the proportion of those living in a nursing home due to hip fracture increased from just 8% in 1994 to 26% in 2002⁵.

Other fragility fractures

Data not provided.

Vertebral fractures

Data not provided.

COST OF FRACTURE

In general, patients with broken hips will wait approximately 2.5 days for hip surgery and over 90% will receive surgical treatment for their fracture. The median time a patient will remain in hospital is 16 days, costing approximately 8,380 USD (10,515 SGD) for the hospital stay (*Table 1*)³. Overall, one study found the total cost of managing hip fractures within the first year after fracture in Singapore to be 17 million USD in 1998, and these costs are estimated to reach 145 million USD annually in 2050⁸.

TABLE 1 Hip fracture in Singapore

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$8,380	16 (median)	>90%

FRACTURE REGISTRIES

Singapore's Ministry of Health (MOH) maintains records, on a national level, of patients admitted to hospitals with a diagnosis of hip fracture. The number of fractures per year and the percentage of those that are surgically treated are tracked for both men and women over the age of 40 years.

FRACTURE LIAISON SERVICES

More than half of the hospitals in Singapore have implemented a Fracture Liaison Service (FLS). This represents the highest implementation of FLS in the Asia-Pacific region.

The high density of FLS can be credited to the *Osteoporosis Patient Targeted and Integrated Management for Active Living* (OPTIMAL) programme. Implemented in 2008, OPTIMAL is a secondary fracture prevention



programme instituted in the public hospitals of Singapore. In this programme, all patients over age 50 years who have suffered a fragility fracture are offered the option to be included in an osteoporosis disease management programme aimed at preventing the occurrence of a second fragility fracture through the judicious combination of appropriate medications, physiotherapy and dedicated nurse manager follow up⁴.

A study performed at Singapore General Hospital (the largest tertiary teaching hospital in Singapore) showed that since the inception of the programme 5 years ago, 1,400 patients have been recruited and 476 patients are currently in active follow-up. Of the 287 patients who had completed a 2-year follow-up, 97.5% had had a dual-energy x-ray absorptiometry (DXA) scan, 62% were compliant with an exercise programme and 72.8% were still compliant with osteoporosis medications after 2 years⁹.

SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Singapore General Hospital is the only hospital in Singapore that has a dedicated Osteoporosis and Bone Metabolism Unit. However all of the hospitals, both public and private, have physicians who manage patients with osteoporosis. Orthopaedic surgeons, endocrinologists and rheumatologists are mainly responsible for managing the care of osteoporosis patients, although the geriatricians, gynaecologists, internal medicine specialists and family physicians also receive specific training on osteoporosis as part of the medical curriculum, and they also manage patients with osteoporosis.

GOVERNMENT POLICIES

Osteoporosis as a documented national health priority

Osteoporosis is a national health priority in Singapore as mandated by the MOH in 2009 along with the publication of national guidelines on osteoporosis.

Many organizations are actively involved in carrying out recommendations in the guidelines by conducting public health education initiatives. Especially active are the Health Promotion Board, The Endocrine and Metabolic Society of Singapore (EMSS) and the Osteoporosis Society of Singapore (OSS).

TABLE 2 Diagnostics access and cost in Singapore

	DXA	ULTRASOUND
Waiting time (d)	7	not recommended
Cost (USD)	87	-
Is it reimbursed?	No (however in public hospitals, it is offered at a subsidized rate)	-
Is reimbursement a barrier to access to treatment?		-

Public health programmes focus on:

- Nutrition (vitamin D/Ca)
- Exercise
- Falls prevention
- Screening

Guidelines

The MOH Clinical Practice Guidelines on Osteoporosis were published in March 2008, and were officially launched on April 4, 2009 at a scientific meeting organized by the MOH and the Osteoporosis Society (Singapore)¹⁰.

These guidelines address population screening (through the Osteoporosis Self-Assessment Tool for Asians - OSTA) but not fracture risk assessment because a FRAX model did not exist in Singapore at the time the guidelines were published. Criteria for treatment are outlined including guidance on medication choices, prior fracture, age, and bone mineral density (BMD).

Audit and quality indicator systems

The secondary fracture prevention programme, OPTIMAL, which is instituted in all the government hospitals and polyclinics of Singapore, has a centralized data entry system that allows for easy audit if necessary.

TREATMENT

The Singapore health-care system does not operate on a reimbursement scheme, therefore, reimbursement is not provided for osteoporosis treatment and care, and

costs are currently borne by the individual patient. To provide some relief, the government does subsidize care based on the financial class of the patient for inpatient care and for outpatient follow-up. However, studies show that osteoporosis care, including medications, remains comparatively expensive, which may contribute to non-compliance by patients. This may then potentially increase the risk of fractures and thus indirectly contribute to health care costs³.

DIAGNOSTICS

The diagnosis of osteoporosis in Singapore is made mainly through assessment by DXA scan, and ultrasound is rarely used (*Table 2*). DXA is widely available in Singapore, and currently there are 16.9 DXA machines available per one million in population¹¹. The waiting time for a scan is approximately a week and the cost is approximately 87 USD – which is not reimbursed but may be subsidized according to the patient's financial state.

RECOMMENDATIONS

- The unmet needs in osteoporosis care and barriers need to be identified in order to find out whether the focus should be shifting from education and preventive measures amongst the public to support for physicians through provision of more resources and modification of existing systems of care³. This includes evaluating the effectiveness of the 2008 Clinical Practice Guidelines and to increase engagement of both primary care as well as specialist physicians in the adoption of the guidelines³.
- Now that the secondary fracture prevention programme, OPTIMAL, is in its fifth year, Singapore can now begin to look at the cost effectiveness of this programme, and document consequent health benefits³.
- Newer studies are needed on fracture incidence and osteoporosis prevalence to assess the current care burden imposed by osteoporosis and its complications in Singapore.

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